

WHAT WE CLAIM IS:

1. An oxynitride fluorescent material, which contains as a main component a JEM phase represented by a general formula  $MA_1(Si_{6-z}Al_z)N_{10-z}O_z$  wherein M is one or two  
5 or more elements selected from the group consisting of La, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb and Lu.
2. The oxynitride fluorescent material according to claim 1, which comprises a JEM phase as a mother crystal with  $M_1$  as a luminescence center, wherein  $M_1$  is  
10 one or two or more elements selected from the group consisting of Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb and Lu.
3. The oxynitride fluorescent material according to claim 1 or 2, which contains at least La and an element  
15  $M_1$  wherein  $M_1$  is one or two or more elements selected from the group consisting of Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb and Lu.
4. The oxynitride fluorescent material according to any one of claims 1 to 3, which contains at least Ce.
- 20 5. The oxynitride fluorescent material according to claim 3, which contains at least Eu.
6. The oxynitride fluorescent material according to claim 3, which contains at least Tb.
7. The oxynitride fluorescent material according to claim 3, which contains at least Ce and Tb.
- 25 8. An oxynitride fluorescent material, which contains elements M, Si, Al, O and N where M is one or two or more elements selected from the group consisting of La,

Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb and Lu, and which has a composition represented by a compositional formula  $M_aSi_bAl_cO_dN_e$  where  $a=1$ , and satisfying all conditions:

- 5             $b = (6-z) \times f$             ... (i)  
              $c = (1+z) \times g$             ... (ii)  
              $d = z \times h$                 ... (iii)  
              $e = (10-z) \times i$             ... (iv)  
              $0.1 \leq z \leq 3$                 ... (v)  
10            $0.7 \leq f \leq 1.3$             ... (vi)  
              $0.7 \leq g \leq 3$                 ... (vii)  
              $0.7 \leq h \leq 3$                 ... (viii)  
              $0.7 \leq i \leq 1.3$             ... (ix)

9.        The oxynitride fluorescent material according  
15 to claim 8, wherein  $f=g=h=i=1$ .

10.       The oxynitride fluorescent material according  
to claim 8 or 9, wherein  $z=1$ .

11.       The oxynitride fluorescent material according  
to any one of claims 8 to 10, wherein M is Ce.

20        12.       The oxynitride fluorescent material according  
to any one of claims 8 to 10, wherein M contains at least  
two elements La and Ce.

13.       The oxynitride fluorescent material according  
to any one of claims 8 to 10, wherein M contains at least  
25 two elements La and Eu.

14.       The oxynitride fluorescent material according  
to any one of claims 8 to 10, wherein M contains at least  
two elements La and Tb.

15. The oxynitride fluorescent material according to any one of claims 8, 9, 10, 12 and 14, wherein M contains at least three elements La, Ce and Tb.

5 16. The oxynitride fluorescent material according to any one of claims 1, 2, 3, 4, 7, 8, 9, 10, 11 and 12, which contains at least two elements La and Ce, wherein a ratio of La and Ce (a ratio of the number of atoms in the composition) is  $0.01 \leq \text{Ce/La} \leq 10$ .

10 17. The oxynitride fluorescent material according to any one of claims 1, 2, 3, 5, 8, 9, 10 and 10, which contains at least two elements La and Eu, wherein a ratio of La and Eu (a ratio of the number of atoms in the composition) is  $0.001 \leq \text{Eu/La} \leq 1$ .

15 18. The oxynitride fluorescent material according to any one of claims 1, 2, 3, 6, 7, 8, 9, 10, 14 and 15, which contains at least two elements La and Tb, wherein a ratio of La and Tb (a ratio of the number of atoms in the composition) is  $0.01 \leq \text{Tb/La} \leq 10$ .

20 19. The oxynitride fluorescent material according to any one of claims 1, 2, 3, 6, 7, 8, 9, 10, 14 and 15, which contains at least three elements La, Ce and Tb, wherein a ratio of La, Ce and Tb (a ratio of the number of atoms in the composition) is  $0.01 \leq (\text{Ce} + \text{Tb})/\text{La} \leq 10$ .

25 20. The oxynitride fluorescent material according to any one of claims 4, 11, 12 and 16, wherein a fluorescence spectrum has a maximum emission wavelength of 420 nm to 500 nm inclusive and an excitation spectrum has a maximum excitation wavelength of 250 nm to 400 nm

inclusive.

21. The oxynitride fluorescent material according to any one of claims 6, 7, 14, 15, 18 and 19, wherein a fluorescence spectrum has a maximum emission wavelength of 480 nm to 560 nm inclusive and an excitation spectrum has a maximum excitation wavelength of 200 nm to 300 nm inclusive.

22. The oxynitride fluorescent material according to any one of claims 1 to 21, which comprises a mixture of the JEM phase and other crystal phase or an amorphous phase, wherein said mixture has a JEM content of 50% by mass or greater.

23. A lighting device, comprising an emission light source and a fluorescent material, wherein a fluorescent material as recited in any one of claims 1 to 22 is at least used.

24. The lighting device according to claim 23, wherein said emission light source is an LED that emits light having a wavelength of 330 nm to 420 nm.

25. The lighting device according to claim 23 or 24, wherein said emission light source is an LED that emits light having a wavelength of 330 nm to 420 nm, and a fluorescent material as recited in any one of claims 1 to 22, a green fluorescent material that emits light having a wavelength of 520 nm to 570 nm inclusive in response to excitation light of 330 nm to 420 nm and a red fluorescent material that emits light having a wavelength of 570 nm to 770 nm inclusive in response to excitation light of 330 nm

to 420 nm are used to mix together red light, green light and blue light, emitting white light.

26. The lighting device according to claim 23 or 24, wherein said emission light source is an LED that  
5 emits light having a wavelength of 330 nm to 420 nm, and a fluorescent material as recited in any one of claims 1 to 22 and a yellow fluorescent material that emits light having a wavelength of 550 nm to 600 nm inclusive in response to excitation light of 330 nm to 420 nm are used  
10 to mix together yellow light and blue light, emitting white light.

27. The lighting device according to claim 26, wherein said yellow fluorescent material is a Ca- $\alpha$ -sialon with Eu in the form of a solid solution.

15 28. An image display comprising an excitation source and a fluorescent material, wherein a fluorescent material as recited in any one of claims 1 to 22 is at least used.

29. The image display according to claim 28, which  
20 is any one of a vacuum fluorescent tube (VFD), a field emission display (FED), a plasma display panel (PDP), and a cathode-ray tube (CRT).